

REMARKS

The Applicants appreciate the thorough examination of the present application as evidenced by the Office Action of May 17, 2004. In particular, the Applicants appreciate the indication that Claim 23 would be allowable if rewritten in independent form. In response, the Applicants have rewritten Claim 23 in independent form and added new dependent Claims 43-47. In addition, the Applicants have amended Independent Claims 1, 19, and 25 to more clearly define the claimed invention. In the remarks provided below, the Applicants will show that all claims are patentable over the cited art. Accordingly, the Applicants respectfully submit that all pending claims are in condition for allowance. A Notice of Allowance is thus respectfully requested in due course.

The Title Has Been Amended

Claims 27-42 were canceled in the Response To Restriction Requirement filed March 31, 2004. The Title has now been amended for consistency with the currently pending claims. Entry of the amended title is thus respectfully requested.

I. Claim 1 Is Patentable

Claim 1 has been rejected under 35 U.S.C. Sec. 102(b) as being anticipated by U.S. Patent No. 4,496,416 to Machler *et al.* (hereinafter "Machler"); under 35 U.S.C. Sec. 102(e) as being anticipated by U.S. Patent No. 6,544,376 to Takemoto *et al.* (hereinafter "Takemoto"); and under 35 U.S.C. Sec. 102(e) as being anticipated by U.S. Patent Publication No. 2002/0172969 A1 to Burns *et al.* (hereinafter "Burns"). In particular, Claim 1 recites a method of positioning a component on a substrate, the method including:

providing a liquid material on the substrate adjacent the component such that the component has a first position relative to the substrate; and
changing a property of the liquid material while in a liquid state to move the component from the first position relative to the substrate to a second position relative to the substrate while the liquid material is maintained in a liquid state.

The Applicant respectfully submits that Claim 1 is patentable over each of Machler, Takemoto, and Burns for at least the reasons discussed below.

A. Claim 1 Is Patentable Over Machler

Machler teaches away from changing a property of a liquid material to move a component while the liquid material is maintained in a liquid state. In particular, Machler states that:

The object is achieved by the invention in the manner that the optical component or its mount is connected to the optical instrument chassis or body during the adjusting process only by an adjusting device which is not part of the instrument, that after the adjusting process the optical component or its mount is firmly attached to the instrument by a solidifying substance, and that thereupon the adjusting device is removed.

For the attaching of the optical component or its mount to the instrument there are preferably used liquid or pasty substances which solidify with little change in volume and therefore remain dimensionally stable.

Machler, col. 2, lines 8-20. (Underline added.) Accordingly, adjustment is performed by an adjusting device as opposed to a liquid. In contrast to the recitations of Claim 1, the liquid or pasty substance solidifies with little change in volume so that the optical component remains dimensionally stable. In addition, Machler discusses that the liquid or pasty substance solidifies as opposed to changing a property of the liquid material while the liquid material is maintained in a liquid state.

Accordingly, Machler fails to teach or suggest the recitations of Claim 1, and Claim 1 is thus patentable over Machler.

B. Claim 1 Is Patentable Over Takemoto

Takemoto similarly fails to teach or suggest changing a property of a liquid material to move a component while the liquid is maintained in a liquid state. As discussed with respect to Figure 30, for example, Takemoto states that:

The UV rays illuminate the adhesive P1 on the interface 4a and the adhesive P2 on the interface 4b via the UV light guides 603 and intermediate members 4 (step S27b). At this instant, the duration of the UV radiation is selected to be long enough to half-cure at least the adhesive P1 on the substantially vertical interface 4a to a degree preventing it from dropping due to its own weight (1 second in the illustrative embodiment). By the UV radiation, the adhesive P1 and adhesive P2 are half-cured temporarily connecting the part 2 and part support 3 via the intermediate members 4.

On the elapse of the above period of time (Y, step S27c), the UV radiation of the UV light source 606 is interrupted (step S27d). In this condition, the position adjustment mechanism 502 is turned on in order to adjust the position of the part or head 2 relative to the part support 3 (step S27a). At this instant, the adhesive P1 and adhesive P2 half-

cured on the interfaces 4a and 4b, respectively, do not drop or turn round to other portions. In addition, the displacement of the part 2 relative to the part support 3 is not obstructed at all.

On the completion of the position adjustment of the part 2 or head (Y, step 27f), the position adjusting mechanism 302 is turned off (step S27g). ...

When the position adjusting mechanism 502 is turned off, the UV light source 806 is again turned on to radiate UV rays. The UV rays again illuminates the adhesive on the intermediate members 4 via the UV light guides 605 and members 4 (step S27h). At this time, the duration of the UV radiation is selected to belong enough to fully cure the adhesive P1 and P2 (40 seconds in the illustrative embodiment). The adhesive P1 and P2 now fully cured firmly connect the part 2 and part support 3 via the intermediate members 4.

Takemoto, col. 23, lines 23-57. (Underline added.) Accordingly, in Takemoto, positioning is performed using position adjustment mechanism 502, half-curing adhesive P1 and/or P2 is performed so that adhesive does "not drop or turn around", and adhesive P1 and P2 is fully cured to firmly connect the part 2 and part support 3 via the intermediate members. Takemoto thus fails to teach or suggest changing a property of a liquid material to move a component while maintaining the liquid material in a liquid state.

Moreover, various additional portions of Takemoto cited in the Office Action also fail to teach or suggest changing a property of a liquid material to move a component while maintaining the liquid material in a liquid state. For example, Takemoto states that:

If light for curing the adhesive applied to the interfaces is not uniformly distributed, a part of the adhesive is rapidly cured while the other part is slowly cured. As a result, the thickness of the adhesive layer differs from the part cured rapidly to the part cured slowly. ... The irregular thickness of the adhesive effects the positional relation between the structural elements and thereby degrades the assembling accuracy of the structural elements.

Takemoto, col. 2, lines 27-39. The cured adhesive, however, is not a liquid so that a property of a liquid material is not changed to move a component while maintaining the liquid material in a liquid state. Takemoto also states that:

As shown in FIG. 33, recesses 3a and 4c may be respectively formed in the lower portion of the part support 3 and the lower portion of the substantially vertical interface 4a to which the adhesive P1 is applied. When the adhesive P1 applied to the interface 4a spreads downward due to its own weight, it is scattered into the recesses 3a and 4c and stopped thereby. As a result, the thickness of the adhesive P1 decreases to, in turn, increase the surface tension of the adhesive P1. The adhesive P1 is therefore prevented from spreading more than necessary, i.e., dropping.

Takemoto, col. 24, lines 58-68. Accordingly, Takemoto appears to relate to preventing spreading adhesive as opposed to changing a property of a liquid material to move a component while the liquid material is maintained in a liquid state.

Accordingly, Takemoto fails to teach or suggest the recitations of Claim 1, and Claim 1 is thus patentable over Takemoto.

C. Claim 1 Is Patentable Over Burns

Burns also fails to teach or suggest changing a property of a liquid material to move a component while the liquid is maintained in a liquid state.

The Applicant will address the rejection based on Burns by addressing the particular statements in the Office Action relating to recitations of Claim 1. In particular, the Office Action states that:

Burns teaches a method of positioning a component (diode, paragraphs 461 and 472) on a substrate by providing a liquid material to the substrate at a first position and changing a property of the liquid while in a liquid state to move the component to the desired second position while in the liquid state (paragraphs 141 and 150-159).

Paragraph 461 of Burns states that "A sensor ... may be fabricated on the surface of silicon wafers as p-n-type diffusion diode," and paragraph 472 of Burns discusses "using a wet thermal SiO₂ layer."

The Applicant respectfully notes, however, that nothing in Burns teaches or suggests moving the p-n-type diffusion diode. Moreover, because the diode is fabricated on the silicon substrate using diffusion, Burns teaches away from moving the diode relative to the substrate. The Applicant further notes that a "wet thermal SiO₂ layer" is not a liquid, and that term "wet thermal" instead refers to a method by which a silicon oxide layer is formed as discussed, for example, in the reference titled "THERMAL OXIDE" at www.processspecialities.com/thermox.htm, a copy of which is attached hereto. More particularly, a "wet thermal oxide" is grown using steam as the oxidation gas while a "dry thermal oxide" is grown using oxygen as the oxidation gas. Accordingly, Burns fails to teach or suggest changing a property of a liquid material to move a component relative to a substrate while maintaining the liquid material in a liquid state.

Paragraph 141 of Burns discusses meltable materials such as solder, wax, polymer, and plastic, and Paragraphs 150-159 discuss moving and mixing nanoliter droplets. Neither of these sections, however, teaches or suggests moving a component relative to a substrate, much less changing a property of a liquid material to move a component relative to a substrate while maintaining the liquid material in a liquid state.

Accordingly, the Applicant respectfully submits that Burns fails to teach or suggest the recitations of Claim 1 and that Claim 1 is thus patentable over Burns.

D. Claim 1 Is Patentable

For at least the reasons discussed above, the Applicant respectfully submits that Machler, Takemoto, and Bender fail to teach or suggest the recitations of Claim 1, and that Claim 1 is thus patentable. In addition, Dependent Claims 2-18, 45 and 48 are patentable at least as per the patentability of Claim 1 from which they depend.

II. Claim 19 Is Patentable

Claim 19 has been rejected under 35 U.S.C. Sec. 102(b) as being anticipated by Machler, and under 35 U.S.C. Sec. 102(e) as being anticipated by Burns. In particular, Claim 19 recites a method of positioning a component on a substrate, the method including:

- providing an initial volume of liquid on a wettable area of the substrate adjacent the component such that the component has a first position relative to the substrate;
- changing the volume of the liquid on the wettable area of the substrate adjacent the component to move the component from the first position relative to the substrate to the second position relative to the substrate while maintaining the liquid in a liquid state;
- and
- after providing the initial volume of the liquid and changing the volume of the liquid, securing the component in the second position relative to the substrate.

The Applicant respectfully submits that Claim 19 is patentable over each of Machler and Burns for at least the reasons discussed below.

A. Claim 19 Is Patentable Over Machler

Machler fails to teach or suggest the recitations of Claim 19 for reasons similar to those discussed above with respect to Claim 1. In particular, Machler states that:

When the concave mirror has been properly adjusted, the hollow space 45 is filled, for instance, with a bonding substance 46 through the channel 44, the substance solidifying with little change in volume.

Machler, col. 6, line 66 to col. 7, line 2. In addition, Machler discusses attaching the optical component using:

Liquid or pasty substances which solidify with little change in volume and therefore remain dimensionally stable.

Machler, col. 2, lines 16-19.

Machler thus teaches away from changing a volume of a liquid to move a component relative to a substrate. Moreover, Machler discusses "substances which solidify with little change in volume", but not changing a volume of a liquid while maintaining the liquid in a liquid state. Accordingly, Machler fails to teach or suggest the recitations of Claim 19, and Claim 19 is thus patentable over Machler.

B. Claim 19 Is Patentable Over Burns

Burns fails to teach or suggest the recitations of Claim 19 for reasons similar to those discussed above with respect to Claim 1.

In particular, portions of Burns cited in the Office Action state that "A sensor ... may be fabricated on the surface of silicon wafers as p-n-type diffusion diode," and paragraph 472 of Burns discusses "using a wet thermal SiO₂ layer." As discussed in greater detail above with respect to Claim 1, however, Burns teaches away from moving the diode relative to the substrate because the diode is fabricated on the silicon substrate using diffusion. As further discussed above with respect to Claim 1, a "wet thermal SiO₂ layer" is not a liquid. Accordingly, Burns fails to teach or suggest changing a volume of wet SiO₂ to move a diode relative to a substrate.

With respect to changing a volume of a liquid, the Office Action cites paragraphs 224-230 of Burns. This section of Burns discusses using internally generated air pressure to split and move drops (see paragraph 224) and movement of discrete microdroplets (see paragraph 227). More particularly, Burns states that:

The present invention describes the controlled movement of liquid samples in discrete droplets in silicon.

Burns, paragraph 229. Accordingly, Burns fails to teach or suggest changing the volume of a liquid to move a component relative to a substrate while maintaining the liquid in a liquid state, and Claim 19 is thus patentable over Burns.

C. Claim 19 Is Patentable

For at least the reasons discussed above, the Applicant respectfully submits that Machler and Bender fail to teach or suggest the recitations of Claim 19, and that Claim 19 is thus patentable. In addition, Dependent Claims 20-24 and 46 are patentable at least as per the patentability of Claim 19 from which they depend. Moreover, Dependent Claim 10 is independently patentable for reasons similar to those discussed above with regard to Claim 19.

III. Claim 25 Is Patentable

Claim 25 has been rejected under 35 U.S.C. Sec. 102(b) as being anticipated by Machler, under 35 U.S.C. Sec. 102(e) as being anticipated by Takemoto; and under 35 U.S.C. Sec. 102(e) as being anticipated by Burns. In particular, Claim 25 recites a method of positioning a component on a substrate, the method including:

providing liquid material on substrate adjacent the component wherein the liquid material is confined to a wettable area of the substrate such that the component is in a first position relative to the substrate; and

differentially heating the liquid material confined to the wettable area of the substrate to move the component from the first position to a second position relative to the substrate while the liquid material is maintained in a liquid state.

The Applicant respectfully submits that Claim 25 is patentable over each of Machler and Burns for at least the reasons discussed below.

A. Claim 25 Is Patentable Over Machler

For reasons similar to those discussed above with respect to Claims 1 and 19, Machler teaches away from differentially heating a liquid material to move a component while the liquid material is maintained in a liquid state. In contrast, Machler discusses using liquid or pasty substances which solidify with little change in volume and therefore remain dimensionally stable. While Machler discusses "adhesives which cure by themselves or under the action of radiation or heat" (col. 2, lines 21-22), Machler fails to teach or suggest differentially heating a

liquid material while the liquid material is maintained in a liquid state. Accordingly, Machler fails to teach or suggest the recitations of Claim 25, and Claim 25 is thus patentable over Machler.

B. Claim 25 Is Patentable Over Takemoto

Takemoto similarly fails to teach or suggest differentially heating a liquid material to move a component while the liquid material is maintained in a liquid state. The Office Action states that "different portions of the liquid are heated to different temperatures (col 2 lines 27-38 and col 24 lines 57-67)." With respect to col. 2, lines 27-38, Takemoto states that:

If light for curing the adhesive ... is not uniformly distributed, a part of the adhesive is rapidly cured while the other part is slowly cured.

Takemoto, col. 2, lines 27-29. With respect to col. 24, lines 57-67, Takemoto states that:

When the adhesive P1 ... spreads downward due to its own weight, it is scattered into the recesses 3a and 4c and stopped thereby. ... The adhesive P1 is therefore prevented from spreading more than necessary, i.e. dropping.

Takemoto, col. 2, lines 61-67. With respect to col. 4, lines 1-8 and lines 51-61 of Takemoto cited in the Office Action, these section discusses "photocuring adhesion" and "half-curing" as opposed to differentially heating a liquid material while the liquid material is maintained in a liquid state. Accordingly, Takemoto fails to teach or suggest the recitations of Claim 25, and Claim 25 is thus patentable over Takemoto.

C. Claim 25 Is Patentable Over Burns

Burns also fails to teach or suggest differentially heating a liquid material to move a component while the liquid material is maintained in a liquid state. As discussed above with respect to Claim 1, cites portions of Burns discuss a "p-n-type diffusion diode" fabricated on a silicon wafer (Paragraph 461) and "using a wet thermal SiO₂ layer" (Paragraph 472), but Burns fails to teach or suggest moving the diffusion diode, and a wet thermal silicon oxide (SiO₂) is not a liquid. While Paragraphs 224-230 discuss "the controlled movement of liquid samples in discrete droplets in silicon" (Paragraph 229), Burns fails to teach or suggest differentially heating a liquid material to move a component. Accordingly, Burns fails to teach or suggest the recitations of Claim 25, and Claim 25 is thus patentable over Burns.

D. Claim 25 Is Patentable

For at least the reasons discussed above, the Applicant respectfully submits that Machler, Takemoto, and Bender fail to teach or suggest the recitations of Claim 25, and that Claim 25 is thus patentable. In addition, Dependent Claims 26, 43-44, and 47 are patentable at least as per the patentability of Claim 25 from which they depend. In addition, Dependent Claim 12 is independently patentable for reasons similar to those discussed above with regard to Claim 25.

IV. Various Dependent Claims Are Independently Patentable

As discussed above each of the dependent Claims is patentable at least as per the patentability of the independent claims from which they depend. Various dependent claims are also independently patentable for at least the reasons discussed below. For example, dependent Claims 10 and 12 are patentable for reasons similar to those discussed above with respect to Claims 19 and 25, respectively.

Dependent Claim 2 is also independently patentable. As Dependent Claim 2 depends from Claim 1, Claim 2 includes all recitations of Claim 1 and the additional recitations of:

before providing the liquid material and changing the property of the liquid material, providing an adhesive material that adheres the component to the substrate wherein the adhesive material is provided in a first state that allows movement of the component relative to the substrate wherein the liquid material and the adhesive material are physically separated; and

after providing the liquid material and changing the property of the liquid material, changing the adhesive material to a second state to secure the component in the second position relative to the substrate.

The Applicants respectfully submit that the cited references fail to teach or suggest changing a property of a liquid material to move a component and changing a property of an adhesive component to secure the component wherein the liquid material and the adhesive material are physically separated. Accordingly, Claim 2 is independently patentable. In addition Claim 48 is independently patentable for reasons similar to those discussed above with regard to claim 2. Moreover, dependent Claims 3-6 are patentable at least as per the patentability of Claim 2 from which they depend.

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Moreover, Dependent Claims 8-9 11, and 13-15 are independently patentable over the cited art. These claims depend from Claim 1 and respectively recite that changing the property of the liquid material comprises "changing a surface tension of the liquid material," "changing an internal pressure of the liquid material," "changing an electrical potential of the liquid material," "changing a pressure exerted by the liquid material against the component", "changing a fluid in contact with the liquid material," and "changing a gas in contact with the liquid material." As discussed above, the cited references fail to teach or suggest changing a property of a liquid material to move a component while the liquid material is maintained in a liquid state. The cited references further fail to teach or suggest changing the particular properties recited in Claims 8-9, 11, and 13-15. According the Applicant respectfully submits that Dependent Claims 88-9, 11, and 13-15 are independently patentable.

While additional dependent claims are independently patentable, further discussion has been omitted for the sake of conciseness.

CONCLUSION

Accordingly, the Applicants submit that all pending claims in the present application are in condition for allowance, and a Notice of Allowance is respectfully requested in due course. The Examiner is encouraged to contact the undersigned attorney by telephone should any additional issues need to be addressed.

Respectfully submitted,


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